Health literacy, socioeconomic status and self-rated health in Japan

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SUMMARY

Health literacy (HL) is a key determinant of health in a contemporary society characterized by abundant information. Previous studies have suggested that basic or functional HL is positively associated with health, whereas evidences on the association between health and communicative/critical HL are scarce. Furthermore, confounding by socioeconomic status on HL-health association has been poorly tested. Using cross-sectional data from a nationally representative community-based survey in Japan, we investigated whether communicative/critical HL is associated with self-rated health independent of socioeconomic status. A total of 1237 subjects participated in this study; the response rate was 62%. To measure communicative/critical HL, we used three questions assessing the respondents' ability to select, to communicate to others and to evaluate specific health-related information. Potential confounders included demographic factors, household income, employment status, and educational attainment. A multivariate model revealed that good self-reported health was significantly associated with younger age [odds ratio (OR), 0.99; 95% confidence interval (CI), 0.97–0.99], employment (OR, 2.89; 95% CI, 1.06–7.88) and higher communicative/critical HL scores (OR 2.75; 95% CI, 1.93–3.90). Respondents with lower education were likely to have poorer communicative/critical HL. These results imply that to close the health gap, policy interventions should focus on the promotion of HL among deprived sociodemographic groups.

Key words: Japan; health literacy; socioeconomic status; perceived health

INTRODUCTION

With rapid advances in healthcare technologies, health information has become increasingly complex. To effectively use the wealth of information and make rational choices to promote health, health literacy (HL) has been regarded as a key determinant in contemporary society (Nutbeam, 2000; Ratzan, 2001; World Health Organization, 2008; Berkman et al., 2011a; Sorensen et al., 2012). According to a widely employed definition proposed by the United States National Library of Medicine (Ratzan and Parker, 2000), HL is ‘the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions’. Nutbeam (Nutbeam, 2000) further refines the concept by classifying HL into functional, communicative and critical categories. Functional HL refers to basic reading and writing skills; communicative HL signifies the more advanced skills required to apply new information to changing circumstances through social interaction. Critical HL indicates the ability to analyze...
information in an effective manner and use it to exert greater control over health situations.

A number of studies have revealed that limited HL is related to worse physical and mental health and poor healthcare utilization (Williams et al., 1998a; Gazmararian et al., 1999; Kalichman et al., 2000; Baker et al., 2002; Schillinger et al., 2002; Scott et al., 2002; Wolf et al., 2004; Howard et al., 2005; Wolf et al., 2005; Davis et al., 2006; Sudore et al., 2006; Baker et al., 2007; Laramée et al., 2007; Bennett et al., 2009; Tokuda et al., 2009; Berkman et al., 2011b). However, those studies focussed mainly on functional HL (Williams et al., 1998a,b; Kalichman et al., 2000; Schillinger et al., 2002; Laramée et al., 2007; Guerra et al., 2008; Chaudhry et al., 2011). Despite recent calls for measuring HL in a community setting (Nutbeam, 2008; Pleasant and Kuruvilla, 2008; Peerson and Saunders, 2009), studies have been limited to measuring HL and health in a community (Wolf et al., 2005; Wolf et al., 2007; Bennett et al., 2009; Wolf et al., 2010). A few exceptions included a study using a national sample of community residents in the UK (though their investigation was limited to functional HL) (Ishikawa et al., 2007; Bostock and Steptoe, 2012) and a national survey in the USA (Kutner et al., 2006).

Recently, the importance of communicative and critical HL has been emphasized as a strong asset to enable people to participate actively in healthcare and health promotion (Ishikawa and Yano, 2008; Chinn, 2011; Sorensen et al., 2012). Ishikawa et al. (Ishikawa et al., 2008b) have developed a measure of communicative and critical HL for diabetes patients in Japan, and they reported statistically significant associations between good communicative/critical HL and diabetes outcomes (Ishikawa and Yano, 2011). The same authors modified the scale to allow its use in the workplace, and they found a significant association between HL and self-reported health and lifestyles among office workers (Ishikawa et al., 2008a). Nevertheless, there is still scant evidence as to whether communicative or critical HL is associated with health outcomes in the general population. In addition, since HL is strongly associated with educational attainment and other socioeconomic indicators (Albert and Davia, 2011), it is debatable whether the association between HL and health outcomes remains after controlling for socioeconomic circumstances (von Wagner et al., 2007; Chinn, 2011; Lai et al., 2013).

Using data from a nationally representative, community-based Japanese survey, the present study investigated whether communicative and critical HL was associated with self-reported health independent of potential confounding factors, including demographics, socioeconomic position and community characteristics.

METHOD

Study participants

In 2006, we conducted a national cross-sectional survey of community-dwelling Japanese between the ages of 20 and 74 years. The sampling strategy for this survey is described in detail elsewhere (Sakurai et al., 2010). In short, we selected our study population using a two-stage random sampling strategy. We classified all 47 prefectures of Japan into 11 regions. The municipalities within each region were further categorized into 19 strata depending on their size (e.g. metropolis, a city of 100 000 or more inhabitants; city of 100 000 or fewer inhabitants and town or village). From the strata, 150 municipalities were selected as survey units proportionate to population size. Finally, 2000 individuals were randomly selected from the basic residential registry of the chosen municipalities. In two municipalities, where the registry was unavailable, we employed a random-walk sampling strategy using the Kish method (Kish, 1965). Each survey site included 13 or 14 candidates. The investigators visited the participants and asked them to respond to a leave-behind questionnaire. A total of 1237 subjects participated in this study; the response rate was 62%. The Institutional Review Board of The University of Tokyo approved the protocol of this study. For our analysis, we employed data on gender, age, self-reported health, employment status, educational attainment, household income and HL of 1217 subjects without missing any variables that were key to our analysis.

Measurements

Self-reported health

Self-reported health was ascertained by a single question—‘What is your current health status?’—to which participants had five response options: excellent, very good, good, fair and poor. There is evidence that self-reported health strongly predicts future morbidity and mortality (Idler and Benyamini, 1997).
Communicative and critical HL

Ishikawa et al. (Ishikawa et al., 2008b) developed a Japanese measure of HL for diabetes patients, covering the three constructs of HL introduced by Nutbeam (Nutbeam, 2000). In their measure, the component for communicative HL has five questions, which cover the following areas: skills related to the collection, extraction and understanding of clinical information on diabetes care; communicating the respondent’s thoughts with others and application of diabetes-related information to actual actions and decisions. Critical HL is evaluated by four questions, which deal with the following: the respondent’s judgment of the validity, reliability and credibility of the information obtained and the collection of information for decision-making. From the measure of Ishikawa et al. (Ishikawa et al., 2008b), we produced the following questions for evaluating the communicative and critical HL of the general Japanese population: ‘How confident are you in the following skills in dealing with information regarding health promotion or medical care?’ This general question contained three subsidiary questions: (i) ‘To select the specific information you need’ (communicative HL); (ii) ‘To communicate the obtained information to others’ (communicative HL) and (iii) ‘To judge the credibility of the obtained information’ (critical HL). The wording of those three questions was similar to that of the three key questions of Ishikawa et al. (Ishikawa et al., 2008b), which had large factor loadings for either communicative or critical HL components. To adapt our measure for a general population, we made some modifications. Each item was measured according to four levels of responses, ranging from 1 (least confident) to 4 (most confident). To obtain an overall communicative/critical HL score for individuals, we calculated the weighted sum of the raw scores for the three items. We conducted a factor analysis to calculate the standardized factor loading scores and used them as the item weight. Internal consistency of these three items was sufficiently high: Cronbach’s alpha for the three items was 0.83.

Covariates

Sociodemographic information included age, gender, occupation, annual pre-tax household income and education. We reorganized the eight original income categories into five. Educational attainment was divided into three categories: elementary or junior high school graduates (compulsory education); high school graduates and higher attainment.

Statistical analysis

First, we evaluated the crude associations among participants’ characteristics, self-reported health and the score of communicative/critical HL using the chi-square test, t-test or analysis of variance as appropriate. Then, we used multivariate logistic regression to determine whether communicative/critical HL was associated with self-reported health independent of age, gender, occupation, income, education, household composition and municipality size. We included municipality size in the model because the availability of health information may vary across municipalities according to their sizes (Ministry of Internal Affairs and Communications Statistics Bureau, 2010). Responses to the self-reported health question were dichotomized by changing the upper two statuses (excellent or very good) to ‘good’; this was because previous studies have identified a tendency for Japanese respondents to choose a middle category (Kuroda et al., 1986), and we believed that excluding the middle category would allow a better classification of the health status. Then, we calculated the odds ratio (OR) and 95% confidence intervals (CI) for reporting health status according to the level of communicative and critical HL. The communicative/critical HL score was tertiled for use in the regression models, because our preliminary analysis suggested a potential non-linear association between HL and self-reported health. In addition, we conducted a series of sensitivity analyses to confirm the robustness of the identified associations by applying an ordered logistic analysis with the dependent variable of five-rank self-reported health without dichotomization and using alternative parameter specifications (i.e. using the continuous HL score or adding the quadratic age term). Statistical analyses were performed using IBM SPSS Statistics version 20.0J, for Windows (SPSS IBM Japan, Inc., Tokyo, Japan). All statistical tests were two-tailed.

RESULTS

The mean age of the participants was 50 years, and 53% were women. Among the participants,
~36% reported good health status. More than half of the participants (55%) were high school graduates, and almost one-third (30%) were college or university graduates. Communicative/critical HL scores significantly varied depending on employment status and were lowest among the unemployed. Individuals with a low level of educational attainment were also likely to have limited communicative/critical HL (Table 1).

The participants who were younger, employed or had high educational attainment and high communicative/critical HL were more likely to report good health status (left columns in Table 2). The multivariate model revealed that good health status was significantly associated with younger age (OR, 0.98; 95% CI, 0.97–0.99), employment (OR, 2.89; 95% CI, 1.06–7.88) and the highest communicative/critical HL scores (OR 2.75; 95% CI, 1.93–3.90). The adjustment for sociodemographic characteristics did not attenuate the ORs of communicative/critical HL scores for good health status (crude OR 2.64 versus adjusted OR 2.75).

### Table 1: Communicative/critical health literacy (HL) and self-rated health (SRH) by sociodemographic characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (n = 1217)</th>
<th>Good SRH (n = 440)</th>
<th>P</th>
<th>Communicative/critical HL, mean (SD)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>641 53</td>
<td>232 36</td>
<td>0.98</td>
<td>3.04 (0.96)</td>
<td>0.06</td>
</tr>
<tr>
<td>Male</td>
<td>576 47</td>
<td>208 36</td>
<td></td>
<td>2.94 (0.98)</td>
<td></td>
</tr>
<tr>
<td>Age: mean (SD)</td>
<td>50.4 14.1</td>
<td>49.2 15.1</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicative/critical HL&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Low</td>
<td>359 29</td>
<td>102 28</td>
<td>&lt;0.0001</td>
<td>1.98 (0.43)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Moderate</td>
<td>598 49</td>
<td>205 34</td>
<td></td>
<td>3.06 (0.31)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>260 21</td>
<td>133 51</td>
<td></td>
<td>4.26 (0.95)</td>
<td></td>
</tr>
<tr>
<td>Municipality size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>132 11</td>
<td>49 37</td>
<td>0.41</td>
<td>2.78 (0.92)</td>
<td>0.01</td>
</tr>
<tr>
<td>Moderate (population of &lt;100 000)</td>
<td>276 23</td>
<td>90 33</td>
<td></td>
<td>3.02 (1.14)</td>
<td></td>
</tr>
<tr>
<td>Large (population of 100 000–499 000)</td>
<td>538 44</td>
<td>194 36</td>
<td></td>
<td>3.03 (0.90)</td>
<td></td>
</tr>
<tr>
<td>Very large (population of 500 000 or more)</td>
<td>271 22</td>
<td>107 39</td>
<td></td>
<td>3.01 (0.93)</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-employed worker</td>
<td>150 12</td>
<td>48 32</td>
<td>0.11</td>
<td>3.10 (1.06)</td>
<td>0.01</td>
</tr>
<tr>
<td>Executive director</td>
<td>64 5</td>
<td>27 42</td>
<td></td>
<td>3.14 (0.88)</td>
<td></td>
</tr>
<tr>
<td>Regular staff</td>
<td>466 38</td>
<td>170 36</td>
<td></td>
<td>2.99 (0.92)</td>
<td></td>
</tr>
<tr>
<td>Non-regular staff</td>
<td>243 20</td>
<td>90 37</td>
<td></td>
<td>2.92 (1.08)</td>
<td></td>
</tr>
<tr>
<td>Other worker</td>
<td>29 2</td>
<td>14 48</td>
<td></td>
<td>3.07 (1.17)</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>33 3</td>
<td>5 15</td>
<td></td>
<td>2.49 (0.94)</td>
<td></td>
</tr>
<tr>
<td>Homemaker/student</td>
<td>232 19</td>
<td>86 37</td>
<td></td>
<td>3.06 (0.87)</td>
<td></td>
</tr>
<tr>
<td>Annual pre-tax household income (million yen)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&lt;2</td>
<td>83 7</td>
<td>28 34</td>
<td>0.13</td>
<td>2.94 (1.19)</td>
<td>0.05</td>
</tr>
<tr>
<td>2–4.9</td>
<td>365 30</td>
<td>124 34</td>
<td></td>
<td>2.94 (0.87)</td>
<td></td>
</tr>
<tr>
<td>5–9.9</td>
<td>372 31</td>
<td>145 39</td>
<td></td>
<td>3.06 (0.94)</td>
<td></td>
</tr>
<tr>
<td>≥10</td>
<td>136 11</td>
<td>59 43</td>
<td></td>
<td>3.13 (0.95)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>261 21</td>
<td>84 32</td>
<td></td>
<td>2.93 (1.07)</td>
<td></td>
</tr>
<tr>
<td>Educational attainment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary/middle school graduate</td>
<td>178 15</td>
<td>52 29</td>
<td>0.03</td>
<td>2.94 (1.29)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>High school graduate</td>
<td>669 55</td>
<td>237 35</td>
<td></td>
<td>2.93 (0.92)</td>
<td></td>
</tr>
<tr>
<td>College/university graduate</td>
<td>370 30</td>
<td>151 41</td>
<td></td>
<td>3.14 (0.86)</td>
<td></td>
</tr>
<tr>
<td>Household composition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third-generation household</td>
<td>182 15</td>
<td>63 35</td>
<td>0.36</td>
<td>2.94 (0.82)</td>
<td>0.11</td>
</tr>
<tr>
<td>Second-generation household</td>
<td>583 48</td>
<td>207 36</td>
<td></td>
<td>2.95 (0.99)</td>
<td></td>
</tr>
<tr>
<td>Couple</td>
<td>272 22</td>
<td>108 40</td>
<td></td>
<td>3.13 (0.96)</td>
<td></td>
</tr>
<tr>
<td>Single household</td>
<td>57 5</td>
<td>15 26</td>
<td></td>
<td>3.00 (1.29)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>123 10</td>
<td>47 38</td>
<td></td>
<td>2.99 (0.92)</td>
<td></td>
</tr>
</tbody>
</table>

SD, standard deviation.

*The number of missing observation was employment status (3), annual pre-tax household income (261), educational attainment (9) and household composition (3), respectively.

*Score tertiled: higher score represents a better HL.
Although a higher socioeconomic position was significantly associated with higher odds of reporting good health status, the ORs for socioeconomic measures were moderately attenuated in the multivariate model. The reductions in the ORs were 10% for employment, 22% for household income and 33% for educational attainment. No interaction terms between socioeconomic positions and communicative/critical HL reached statistical significance (data not shown, available upon request).

The results of our sensitivity analysis using ordered logistic regression were similar to those of the regular logistic regression. Further sensitivity analyses employing alternative specifications of the explanatory variables also produced similar results (data not shown, available upon request).

### DISCUSSION

To the best of our knowledge, this is the first community-based study to find a strong association between communicative/critical HL and self-reported health independent of individuals’ demographic backgrounds and socioeconomic positions, using a nationally representative sample of a general population. Previous studies evaluating communicative and critical HL have mainly been in clinical settings (Levin-Zamir and Peterburg, 2000).
In fact, the association between educational attainment and self-reported health was considerably attenuated after adjustments were made for communicative/critical HL; this suggests that health education aiming to promote communicative/critical HL could potentially reduce health disparities. Nevertheless, health education programs may be less effective for groups with low socioeconomic status because of their poor perception of their own health status, their low use of health education resources and their limited access to relevant educational services and social support (Calnan, 1986; Jackson et al., 1991; Lee et al., 2004; Lorenc et al., 2012). Therefore, health education interventions should be designed based on a good understanding of the patterns of resources available among different sociodemographic groups; such interventions should combine multiple approaches, such as those specifically targeting disadvantaged groups and developing the capacity of the community as a whole to act using available social resources (World Health Organization, 2010).

Wolf et al. (Wolf et al., 2005) found a significant association between functional HL and health status measured using MOS SF36 among a US elderly population; however, this association was considerably attenuated after adjustment for income and education, which suggests that the association between functional HL and health was largely explained by low education and income status. In our study, however, the adjustment for socioeconomic position had little effect on the OR for communicative/critical HL and health. This might reflect the small variability in the attainment of basic education among the Japanese population. In Japan, the average number of years of completed schooling is 12.3, and as of 2010 ~ 88% of the population aged between 20 and 74 years attended high school and higher education (Ministry of Internal Affairs and Communications Statistics Bureau, 2012). Among Organization for Economic Co-operation and Development countries, Japan ranked third in terms of upper-secondary level graduation rates in 2008 (Organization for Economic Co-operation and Development, 2010).

Our study had some limitations. First and foremost, the cross-sectional nature of its design did not enable us to evaluate the temporal associations between HL and health. Secondly, our measure of health was based on self-reporting, which is susceptible to endogeneity problems given the parameters used in our statistical
models. Thirdly, our measure of HL was not fully validated, although no standardized, validated measure of communicative/critical HL for a general population currently exists in Japan. The items used in our measure shared most of the wording used in an existing validated measure of HL for Japanese-speaking diabetes patients (Ishikawa et al., 2008b). We partly confirmed its reliability by finding very high internal consistency among the three items included in the measure. Finally, we did not assess functional HL because of the limited space in our questionnaire. However, the questionnaire used in this survey was self-administered, and understanding and answering it required functional literacy in Japanese. Those who refused to answer amounted to 23.8% of the total sampling population, and there was no significant difference in the likelihood to refuse in terms of age, sex, city size and urban or rural residence (data available on request). In addition, the latest government census in 2010 indicated that 88.3% of the population aged between 25 and 74 years were graduates of high school or had undergone more advanced education; the corresponding figure in our sample was 85%, which suggests that the sample was fairly representative in terms of educational background for the Japanese population. Thus, we believe it unlikely that refusal to participate in the study was based on the respondents’ poor functional HL.

Despite these limitations, our study demonstrated a significant association between communicative/critical HL and health status independent of socioeconomic position. Respondents with lower socioeconomic positions were likely to have poorer communicative and critical HL. These results imply that to close the health gap, promoting both fundamental and communicative/critical HL across different sociodemographic groups should be an important focus of policy interventions.

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